OBSERVATIONS ON

BELEMNITES,

AND OTHER

FOSSIL REMAINS OF CEPHALOPODA,

DISCOVERED BY

MR. REGINALD NEVILLE MANTELL, C.E.

IN THE OXFORD CLAY NEAR TROWBRIDGE, IN WILTSHIRE.

BY

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PHILOSOPHICAL TRANSACTIONS.

XII. *Observations on some Belemnites and other Fossil Remains of Cephalopoda, discovered by Mr.* Reginald Neville Mantell, *C.E. in the Oxford Clay near Trowbridge, in Wiltshire.*

By Gideon Algernon Mantell, *Esq., LL.D., F.R.S., F.L.S.,*
Vice-President of the Geological Society.

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THE group of argillaceous deposits of the Oolite or Jurassic formation, termed the Oxford Clay, has yielded some of the most interesting and instructive examples of the fossil remains of Cephalopoda hitherto discovered in England. Christian-Malford, in Wiltshire, is especially celebrated for the very perfect specimens of the soft parts of certain extinct forms of this class of molluscous animals; examples having been obtained in which the body and muscular tunic or mantle, the cephalic arms with their uncinated acetabula, the capsule or external tunic of the eye-ball, the ink-bag, and the phragmocone, are preserved, and in some instances but slightly displaced from their natural relative positions and connections. The remarkable fossils described in the Memoir on the Belemnite* by Professor Owen, were procured by the Marquess of Northampton, Mr. Cunnington, and Mr. Pratt, from this locality.

A branch line from the Great Western Railway to Trowbridge in Wiltshire, now in progress, in some parts passes over, and in others cuts through, the usual series of oolitic strata of that part of England; namely, the Kimmeridge Clay, Oxford Clay, Kelloway Rock, and the Great Oolite with its subordinate beds of Cornbrash, Forest Marble, Bradford Clay, &c.† My son, Mr. Reginald Neville Mantell, who is engaged on this work under the eminent engineer I. K. Brunel, Esq., availed himself of this favourable opportunity of collecting a very extensive suite of the fossils brought to light by the various cuttings and excavations required in the construction of the railway. This collection comprises many hundred specimens of the shells and

* Philosophical Transactions for 1844, p. 65.

† Wonders of Geology, 6th edition, p. 502.

other organic remains which usually abound in this division of the Oolite formation, and among them are several unique and exquisite examples of Ammonites, Belemnites, &c. Imbedded with the animal remains were large quantities of drifted wood, and stems and branches of trees: some of these specimens are in the state of bog-wood and lignite; others are transmuted into limestone, and have the original structure well-preserved. Trunks and branches of coniferous trees, from ten to twenty feet in length, and from a few inches to upwards of a foot in diameter, were abundant; a few traces of the foliage of Cycadeaceous plants, and of Araucariæ, were likewise met with.

The geological character of the beds of Oxford Clay exposed along this railway, is that of a fluvio-marine formation; that is, an accumulation of deep sea and littoral shells, promiscuously intermingled with the debris of terrestrial vegetables brought into the sea from distant lands by the agency of streams and rivers, and transported by marine currents into the bed of the ocean. It would be highly interesting, but irrelevant to my present purpose, to dwell on the geological phenomena presented by the sections laid bare by the operations of the engineer along this tract of ten or twelve miles. The great quantity of the shells of mollusks referable to species which dwell in the profound abyss of the ocean, collocated with those which can exist only in waters of moderate depths, and the intercalation of drifted trees and plants, formed a striking illustration of the nature of the bed of the ancient oolitic sea, strewn with the spoils of the land, and the exuviæ of the animals with which the waters of that ocean were densely inhabited*.

As the Oxford Clay traversed by the Trowbridge line is a continuation of the beds that were cut through at Christian-Malford, whence all the specimens of Cephalopoda collected by Mr. Buy, the well-known fossil dealer of Chippenham, were procured, my son's attention was particularly directed to the discovery of examples that would tend to elucidate the nature of the soft parts of the animal to which the Belemnite belonged; for notwithstanding the memoir above referred to, doubts were entertained by several competent observers as to the validity of the arguments which led Professor Owen to assign the fossil Cephalopod, termed *Belemnoteuthis antiquus* by the late Mr. Channing Pearce, and described by him in 1842†, to the same genus as the true Belemnite, and to the species named *B. Owenii* by Mr. Pratt.

Care was therefore taken to remove, when practicable, the Belemnites, Ammonites, &c. with a large portion of the surrounding clay; and this, when hardened by drying,

* My son's collection comprises very fine specimens of *Ammonites Königi, A. Calloviensis, A. sublævis, A. athleta*, &c.; beautiful examples of a boat-like ammonite with a sharp keel, *A. Chamusseti*; a large depressed ammonite with a flat back and a single row of nodular tubercles on the wreaths; several kinds of *Nautilus*; numerous small shells of the genera *Rostellaria, Terebra, Turritella, Trochus*, &c.; *Ostrea deltoidea, Gryphæa dilatata, Terebratula*, &c.; bones of *Ichthyosauri, Plesiosauri, Teleosauri, Cetiosauri*, &c.; and a few scales and teeth of fishes.

† Geological Proceedings for 1842, vol. ii. p. 593; but not referred to in Professor Owen's memoir.

was diligently examined to ascertain whether there were any remains, or traces of the imprints, of the soft and perishable parts, of the bodies of the original animals. Although these researches were not rewarded by the discovery of any good examples of the muscular tunic, arms, &c. of the Cephalopoda, whose hard and durable relics are scattered in profusion through the strata, there are in the collection my son transmitted to me, a few specimens which present characters hitherto unobserved, or at least unnoticed, by any author, and which appear to me of sufficient importance to be placed on record, as interesting additions to our knowledge of the structure of the animal of the Belemnite.

In the following remarks I shall restrict myself to the description of the fossils, of which accurate figures by Mr. Joseph Dinkel, executed under my immediate inspection, are subjoined; and the bearing of the facts described on the still mooted question as to whether the Belemnoteuthis and the Belemnite belong to the same genus; in other words, whether the soft parts of Cephalopoda found in the Oxford Clay of Wiltshire, and figured and described by Mr. Channing Pearce, Professor Owen, and Mr. Cunnington, belong to the Belemnites geologically associated with them, but with which they have never yet been found in organic connection.

The late Mr. Channing Pearce, whose early death every British palæontologist must deeply regret, was the first who noticed and described the muscular mantle, phragmocone, uncinated arms, &c. of certain Cephalopods found in the Oxford Clay at Christian-Malford, and which he referred to a new genus under the name of *Belemnoteuthis*. According to the observations of this gentleman, and of subsequent authors, the body of this Cephalopod was of an elongated form, and contained a large internal conical shell, which is chambered and siphonated at its apical or distal extremity to the extent of about one-half (?) the length of the entire cone, and terminates anteriorly, or at its basal part, in a capacious chamber or cavity, in which the ink-bag, and probably other viscera, were placed. The external surface, which is of a brown colour, generally possesses a glossy smoothness, as if produced by its immediate contact with the secreting surface of the mantle. The outer integument of this conical shell consists of a thick corneo-calcareous layer (which for convenience I will call the epidermis), investing a nacreous, iridescent substance. Two large sessile eyes have been detected, and in several specimens the cephalic arms are more or less perfectly preserved; there are likewise indications of a pair of long tentacula, superadded to the eight shorter arms, as in the existing *Decapods**. The arms were furnished with acetabula or suckers, the horny hoops of which were beset with curved spines or hooks, as in the living *Onychoteuthis*. Traces of a pair of pallial fins have been detected by Professor Owen, to whose memoir I would refer for minute details of structure, which are not within the scope of the present communication†.

* Professor Owen, Philosophical Transactions, 1844, p. 78.

† Ibid. p. 79.

The outline, Plate XIV. fig. 1, is intended to convey an idea of the form of the animal of the *Belemnoteuthis*, so far as the fossils hitherto discovered warrant the restoration; of course this sketch is only approximative, and is given as a mere diagram of what is *actually known* as to the shape and structure of the original, and not as an accurate delineation of the living animal; for there are strong reasons to conclude that the phragmocone was wholly internal, or at least was covered by the skin. The above is, I believe, a correct description of the *Belemnoteuthis*, and of the form and relations of the several parts of its structure: it is based on the specimens described and figured by Mr. Channing Pearce, Professor Owen*, and Mr. Cunnington†, and others in my possession.

Now in order to connect the body of the Cephalopod above described with the elongated conical fossil commonly known as the *Belemnite*, and termed by naturalists the *guard* or *osselet* of the same, it has been assumed that the terminal chambered cone of the former (Plate XIII. figs. 2, 3, 5) was originally implanted in the alveolus or cavity of the latter; like the unquestionable phragmocone of a Belemnite, represented in Plate XV. figs. 4, 5, *a*, *a*. It follows, if we admit the correctness of this interpretation, that every example of the chambered conical shell of a Cephalopod, found in the Oxford Clay, is the phragmocone of a Belemnite that has slipped out of the alveolus of the guard, and been compressed into its present shape by the weight of the superincumbent strata. Upon the correctness of this supposition the generic identity of the *Belemnoteuthis* and the *Belemnite* entirely rests; for no specimen has yet been met with, in which the guard of a Belemnite is in *natural contact* with the muscular mantle, and other soft parts. If the phragmocone of the Belemnite, and the chambered shell of the Belemnoteuthis be not identical, then we know nothing whatever, *from actual observation*, of the soft parts of the animal to which the Belemnite belonged: to this point therefore I would first solicit particular attention.

Phragmocone of the Belemnoteuthis.—As the figures in the Philosophical Transactions, 1844, Plate III., &c., and in the London Geological Journal, Plate XV. XVI., show the phragmocone in natural connection with the muscular tunic or mantle, &c., I need not adduce further examples of this undisputed fact, and will therefore only remark, that such specimens are of rare occurrence: in most instances, the detached chambered shell, more or less flattened, is found imbedded in the clay, with but few, if any, vestiges of the soft parts, as in Plate XIII. figs. 1, 2, 3, 5. In this state, these fossils occurred by hundreds on the newly-exposed surface of the Oxford Clay near Trowbridge. My son describes some areas when first laid bare by his labourers, as being literally spangled over with the nacreous cones of Belemnoteuthes, and the splendid iridescent shells of Ammonites; while here and there Belemnites of large size, with their phragmocones attached, were lying in relief. Upon drying, the thin

* Philosophical Transactions, 1844, p. 77–80, Plates III. IV. V. VI.

† London Geological Journal, Plates XV. XVI.

nacreous shelly covering cracked to pieces, and flaked off from the clay: the illustrative examples presently to be described, were preserved by imbuing them with a thick solution of gum, and allowing them to dry, before attempting to dig them up. From a great number of specimens I have selected four (Plate XIII. figs. 1, 2, 3, 5.) in illustration of the form and structure of the phragmocone of the Belemnoteuthis. Figs. 2, and 3, exhibit, as I believe, the perfect shell, with the peristome, or mouth of the large anterior or basal chamber, entire. Although both these fossils are much compressed, the cavity of the receptacle filled with clay is distinctly seen in fig. 2: in fig. 3, the margin of the peristome (*a*) is only visible on one side, owing to the position of the shell in the clay. In both specimens the distal extremity is perfect; it terminates in a blunt point, having a longitudinal ridge on the side exposed, which probably indicates the dorsal aspect: in other instances, the corresponding space on the opposite or ventral side is occupied by two elevated, flat, slightly divergent longitudinal bands, as in Plate XIII. fig. 5; in fig. 2, the thick corneo-calcareous epidermis covers the lower part of the cone, but is in a great measure removed from the upper portion, and the pearly or nacreous layer of shell which lies beneath is exposed. The epidermis in fig. 3, though much cracked by pressure, extends over the greater part of the shell.

The descriptions of the phragmocone of the Belemnoteuthis, as given by Mr. Channing Pearce and Mr. Cunnington, accord in every respect with my own observations. Mr. Cunnington particularly dwells on the constant and uniform occurrence of the two strongly-marked ridges which extend upwards from the apex in a nearly parallel direction. "These," he observes, "are shown in Plate II. fig. 6. of Professor Owen's paper, and are regarded by that gentleman as resulting from the accidental crushing of the shell. I have, however, before me thirteen specimens, in which these ridges, though in some instances displaced by the compression they have undergone, are yet so distinct, and so constantly exhibit the same relative proportions and distances, that it is impossible not to regard them as resulting from original structure. A transverse section shows that these ridges are formed by an elongation of the fibres, and consequent thickening of the shell. Moreover, they are always exceedingly distinct in those specimens where the apex is solid—as is sometimes the case to the extent of half an inch—and has resisted the force that has compressed the rest of the shell. *It is obvious that this structure could never have fitted into the circular cavity constituting the alveolus of the Belemnite**." My son long since pointed out to me the marked difference in the form of the respective shells; that of the Belemnite being an elongated cone (Plate XV. figs. 4, 5, *b*), and that of the Belemnoteuthis more obtuse (Plate XIII. figs. 4, 5); and he remarked that no amount of pressure could reduce the former into the same angle as the latter.

[In the cabinet of the late Mr. Channing Pearce, there is a portion of a phragmocone of a Belemnoteuthis which is less compressed than any other specimen I have

* London Geological Journal, pp. 98, 99.

seen, and is also the only instance in which the true external surface of the epidermis is preserved. Through the kindness of Mr. Charlesworth I have been favoured by Mr. Pearce, Senior, with the loan of this fossil, which is represented in Plate XIII. fig. 1. The external pellicle, though cracked, is almost entire, but is removed in a few places (*a*, *a*, *a*), so as to expose the brown corneo-calcareous layer which in most specimens appears as the outer case, as in Plate XIII. figs. 2, 3. The surface is very finely striated with delicate interrupted elevated lines, disposed in a longitudinal direction, as shown in the slightly enlarged drawing of part of the same at fig. 1 *a*. This structure appears to be analogous to that observable on the back of the sepiostaire of the Cuttle-fish, and on the guards of certain species of Belemnites; but I have never observed any traces of such a texture on the surface of the phragmocones of the latter, which invariably presents the characters delineated in Plate XV. fig. 4, *a*.]*

According to the facts at present known, the chambered cone of the Belemnoteuthis appears to me to approximate most nearly to the *Beloptera*†, which has a horny calcareous conical shell with transverse septa, and is destitute of a guard.

The Belemnite.—To avoid unnecessary details, I beg to refer to Dr. Buckland's Bridgewater Essay‡, Professor Owen's Hunterian Lectures§, and my Medals of Creation‖, for descriptions and figures of the form and structure of the Belemnite as indicated by the specimens then known; and I now proceed to describe the most illustrative example from Trowbridge, which is represented (somewhat less than half the size of the original) in Plate XV. fig. 3. This fossil comprises the following parts:—

1. *The Capsule*¶ or *periostricum*; this external investment (*c'*, *c'*, *c'*), which consists of a thin shelly or corneo-calcareous integument that closely embraces the guard, and gradually enlarging upwards, finally surrounds the peristome of the phragmocone, constituting the thin horny laminated sheath or receptacle (*c*, *c*), has been described by all previous observers as an extension of what they termed the sheath or capsule; within this receptacle the ink-bag and other viscera were probably contained.

2. The *Guard* or *Osselet* (Plate XV. figs. 1, 2), which is the fossil known to collectors as the Belemnite. This is an elongated conical body, of a fibro-calcareous spathose structure, diminishing in size towards its distal extremity, and terminating in a point. At the basal, or opposite end, it is truncated, and has a deep conical cavity termed the *alveolus*, which contains the siphonated apical portion of the phragmocone.

3. *The Phragmocone* (Plate XV. figs. 3, 4, 5, *a*, *a*): this is a thin shelly inverted cone; the distal part containing a series of from twenty to thirty air-chambers or cells,

* *Received March* 16, 1848.—S. H. C.

† See Dr. Buckland's Bridgewater Essay, Plate 44', fig. 15.

‡ Ibid. Section VII. p. 371. § Vol. i. p. 333. ‖ Vol. ii. p. 462.

¶ I would restrict the term sheath, or *capsule*, to this outer corneo-calcareous case or integument, for the phragmocone cannot properly be said to have a capsule, its conical shell being inseparably connected with the transverse septa; it would be quite as correct to designate the involuted part of the shell of a Nautilus by this term, as the conical shell of the phragmocone of a Belemnite.

formed by concavo-convex transverse septa or plates. This apparatus has been aptly compared by Dr. Buckland to a pile of watch-glasses, gradually diminishing in size towards the apex; the septa are perforated by a tube or siphunculus, which is situated on the ventral margin. The phragmocone enlarges upwards, and anteriorly to the siphonated part constitutes a large chamber, from the margin of which are produced two, or more, long, upright, shelly or calcareous processes, as shown in Plate XV. fig. 3, *b*, *b'*; these were probably for the support of the soft parts, or for the attachment of muscles. Whether there were similar processes on the opposite margin of the chamber cannot be determined, as the peristome is imperfect.

The figure in outline, Plate XIV. fig. 2, is intended to define these several parts more clearly.

a, *a*, *a*. The *Capsule, periostricum*, or external sheath of the Belemnite, now first described.

b. The *Guard* or *Osselet*.

c. The apical chambered part of the phragmocone which is situated in the *alveolus* or cavity of the *guard*.

d. The visceral or basal chamber of the phragmocone.

e, *e*. Two elongated processes produced from the margin of the peristome of the visceral chamber; observed for the first time.

In the specimens delineated, Plate XV. figs. 1 and 2, the guard is in great part covered by the external integument or shelly capsule (*c'*, *c'*, *c'*), which is very thin, and resembles in colour and in its glossy appearance, the outer coat or epidermis of the phragmocone of the Belemnoteuthis (Plate XIII. figs. 2, 3). The capsule is seen adherent to the crushed phragmocone beyond the upper part of the guard in Plate XV. fig. 2; and in fig. 3 it is shown to be continuous with the horny receptacle into which it ultimately expands (*c''*).

Professor Owen detected on the exterior surface of some spathose guards obtained from the Oxford Clay, "traces of a more immediate investment of a thin friable layer of white calcareous matter, analogous to that of the outer layer of the sheath of the phragmocone;" but the specimens were evidently too imperfect to demonstrate the nature of this *periostricum*, and its identity with the expanded capsule or horny receptacle above; for the phragmocone is erroneously described as having a sheath "continued backwards to line the alveolar cavity, and forwards from its basal outlet to form the visceral chamber anterior to the phragmocone*."

The appearance of the surface of the phragmocone situated in the alveolus, when first exposed by breaking away a portion of the investing guard, is represented, Plate XV. fig. 4, *a*; and the same specimen with part of the shell removed, to show the edges of the plates of the air-chambers, in fig. 5, *a*. The annular risings and depressions on the surface of the shell, fig. 4, *a*, indicate the situation of the concavo-convex transverse septa. The phragmocones of the Belemnites in the Oxford

* Philosophical Transactions, 1844, p. 69.

Clay of Wiltshire are not symmetrical; but the apex of the cone inclines to one side in consequence of the position of the axis of the guard, and terminates in a very fine point, as in the example, fig. 4. In this specimen the cells are filled with calcareous spar, as is frequently the case with that portion of the phragmocone which is implanted in the alveolus; a fact doubtless connected with the similar mineral state of the osselet itself. The latter is almost invariably saturated as it were with crystallized carbonate of lime of a brown colour and radiated structure; for notwithstanding the microscopical observations of Dr. Carpenter and Professor Owen, I think the evidence is in favour of the conclusion of the Dean of Westminster, that this crystalline condition has resulted from sparry infiltration, subsequently to interment, into the cellular and radiated calcareous texture of which the osselet was originally composed*; in like manner as the crustaceous coverings and spines of the Echinoderms in the Oolite and Chalk, are so saturated with calc-spar as to have acquired the hardness and peculiar oblique fracture of the crystalline mineral matter.

The facts above described appear to me to confirm the opinion advanced by Mr. C. Pearce and Mr. Cunnington, that the Belemnoteuthis is generically distinct from the Belemnite. In addition to the discrepancies in the form and structure of the phragmocones of the respective Cephalopods, pointed out by these observers, the specimen represented, Plate XV. fig. 3, demonstrates that in the Belemnite there are two other essential characters of which no traces have been detected in the Belemnoteuthis; namely, the periostricum, capsule, or external corneo-calcareous investment (c', c, c); and the processes that extend from the basal margin of the visceral chamber (b, b'), the peristome of the Belemnoteuthis being entire (Plate XIV. figs. 3, 4). It is worthy of remark, that the surface of the capsule of the Belemnite, and that of the phragmocone of the Belemnoteuthis, are alike smooth and glossy; as if in the one the osselet, &c., and in the other the chambered shell, were originally wholly enveloped by the mantle. But the exterior of the siphonated phragmocone of the Belemnite is devoid of polish, and is in such close contact with the walls of the alveolus, that it is very rarely the shell can be displayed entire as in the specimen, Plate XV. fig. 4.

If it be contended that upon physiological grounds the phragmocone of the Belemnoteuthis must have been implanted in the alveolus of a guard or osselet, I would reply that none of the species of Belemnites with which these chambered cones are associated in the Oxford Clay of Wiltshire, can have belonged to them, for the reasons already assigned; and a guard has still to be discovered that shall meet the exigencies of the case. If, therefore, with our present scanty information, we affirm that the Belemnite and the Belemnoteuthis belong to one and the same genus, I respectfully submit that we are not only reasoning in advance of the data hitherto obtained, but contrary to known facts.

From a tolerably extensive knowledge of the fossil Cephalopoda of the argillaceous strata of the Oolite and Lias, I am led to conclude that the Oxford Clay of Wiltshire

* Bridgewater Essay, p. 372.

contains the remains of at least three genera of naked Cephalopods; namely, the Belemnite, Belemnoteuthis, and a true Calamary with a horny dorsal gladius or pen. In the two last, vestiges of an ink-bag, or of its inspissated contents, are generally manifest; but I have never detected the slightest trace of the existence of such an organ in natural connection with any part of a Belemnite; and I learn from M. Van Breda, that in the very large collection of Belemnites of the late Count Munster, there was not one unequivocal instance of this kind. If in the specimens figured in the Bridgewater Essay, Plate 44′, fig. 7, the ink-bag be in its natural position, and not merely in accidental apposition with the basal chamber of the phragmocone of a Belemnite, of course the question as to whether this genus of Cephalopods was furnished with such an organ, is decided in the affirmative.

In conclusion, I would state, that although I am of opinion that the body and soft parts, and consequently the true characters of the animal of the Belemnite, have yet to be discovered, I do not question the soundness of the views of the correlation of cephalopodal organization, and of the physiological inductions resulting therefrom, enunciated in the memoir on the Belemnite by the Hunterian Professor. That the unknown animal of the Belemnite closely approached the Belemnoteuthis, both in form and structure, is highly probable, but proofs are yet required to confirm the inferences of the physiologist.

19 *Chester Square, Pimlico,*
February 1848.

Description of the Plates.

All the figures are from specimens in my possession, and of the natural size, with the exception of fig. 3, Plate XV., which is much reduced, the original specimen being twenty-two inches long.

PLATE XIII.

Figs. II. III. V. Phragmocones of *Belemnoteuthis antiquus*.

a. The basal or upper or anterior part, forming a chamber for the ink-bag, and probably other viscera.

b. The apical or distal termination of the shell.

Fig. I. The apical portion of the phragmocone of a Belemnoteuthis invested with the external integument; at *a*, *a*, *a*, is seen the corneo-calcareous layer which lies beneath.

Fig. I^a. Part of fig. 1, slightly magnified to show the striated surface; *a*. marks a denuded space, exposing the internal layer.

Fig. II. Shows the perfect form of the peristome, *a*; though much compressed, the cavity of the chamber, partially filled with clay, is well-defined.

Fig. III. This specimen is also perfect, but in consequence of its position in the clay, only one-half of the basal or upper part of the margin of the peristome (*a*) is visible.

Fig. IV. *Ammonites Jasoni*, from Trowbridge, with two elongated processes extending from the margin of the aperture, bearing some analogy to the shelly prolongations from the peristome of the Belemnite, Plate XV. fig. 3, *b*, *b'*.

Fig. V. A phragmocone showing the ventral (?) aspect of the chambered apex, with two parallel longitudinal bands extending upwards (*b*).

PLATE XIV.

Fig. I. A restored outline of the animal of the Belemnoteuthis, so far as at present known.

a. The cephalic arms.

b. Remains of a pair of long tentacula.

c. The eyes.

d. The pallial fins.

e. Ink-bag.

f, *f*. The mantle.

g. The phragmocone; the letter indicates the visceral chamber of the same.

i. Apical or distal part of the phragmocone.

k. Two longitudinal bands on the ventral aspect of the same.

Fig. II. Outline of the known parts of the Belemnite.

a, *a*. The capsule or *periostricum*.

a', *a'*. The horny expansion of the same forming the receptacle which surrounds the basal chamber and peristome of the phragmocone.

b. The guard or osselet, one-half being removed to show the radiated structure, and the alveolus with the apical part of the phragmocone, at *c*.

c. The chambered distal extremity of the phragmocone.

d. The visceral chamber of the same.

e, *e*. Two calcareous processes arising from the margin of the peristome at *f*, *f*.

Fig. III. Phragmocone of Belemnoteuthis.

a. The visceral chamber.

b. Ridge on the dorsal side of the apex.

Fig. IV. A phragmocone of Belemnoteuthis seen on the ventral aspect.

b. Two nearly parallel elevated longitudinal bands.

PLATE XV.

Fig. I. The guard or osselet of a Belemnite (*B. attenuatus*) invested by the *periostricum*, or external shelly capsule, c', c', c'.

a. Part of the chambered phragmocone seen in the alveolus.

Fig. II. Another example of *B. attenuatus*, on which a large portion of the capsule remains, c', c'.

Fig. III. Exhibits the most considerable part of the structure of the Belemnite hitherto discovered. The original is twenty-two inches in length.

a, *a*. Remains of the basal portion of the shelly phragmocone; the apical chambered extremity is concealed by the investing capsule and guard, *c*, *c*.

b, *b*. Two shelly processes proceeding from the margin of the peristome.

c, c', c''. The capsule partially investing the guard (at c'), and extending upwards conceals at *c*, *c*, *c*, the siphonated part of the phragmocone, and expands into the horny receptacle (c''), within which the peristomal processes (*b*, b') are contained.

A layer of dark brown animal matter extends from within the outline of the capsule at c'', under the processes of the peristome; and is probably the remains of the soft parts that occupied the interval between the receptacle and the phragmocone. The band on the left of the process *b*, presents a fibrous structure (*d*, *d*), and is marked with oblique lines, as if it were part of the muscular tunic or mantle.

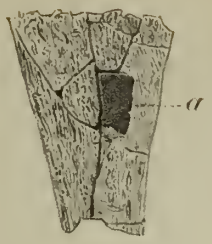
Fig. IV. The alveolar part of the guard of a Belemnite split open longitudinally to show the apical chambered portion of the phragmocone (*a*), with the shell perfect, and imbedded in the alveolus. The phragmocone terminates in a very fine point, and is unsymmetrical; inclining considerably to one side, in consequence of the position of the axis of the guard (*c*). A comparison of this figure with figs. 2, 3, 5, Plate XIII., will at once enable the observer to perceive how essentially the phragmocone of the Belemnite differs from that of the Belemnoteuthis.

b. The radiated fractured surface of the spathose substance of the guard.

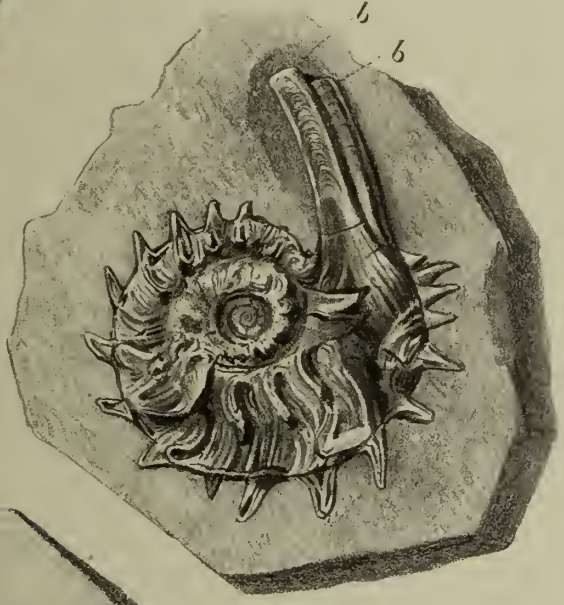
Fig. V. The same fossil, with the phragmocone partially divested of the outer shell, to display the edges of the transverse septa. I have never seen in the Oxford Clay, the apical part of the phragmocone of a Belemnite detached from the alveolus.

I

I[a]



V



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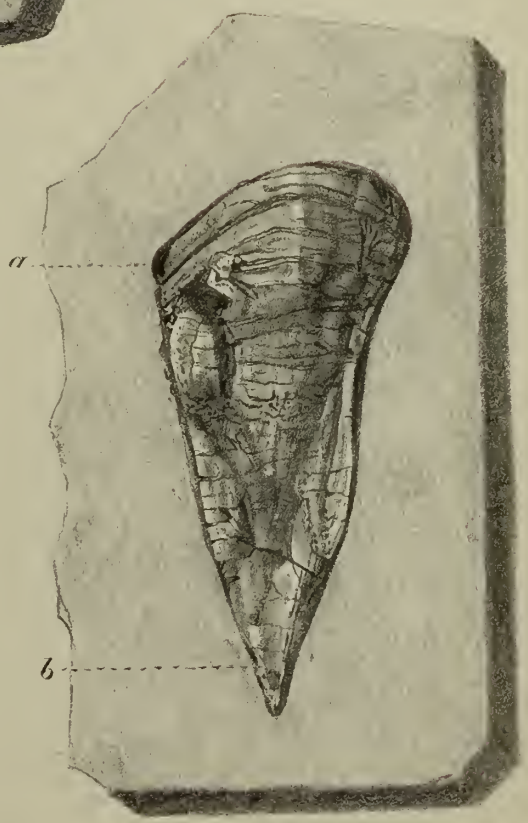

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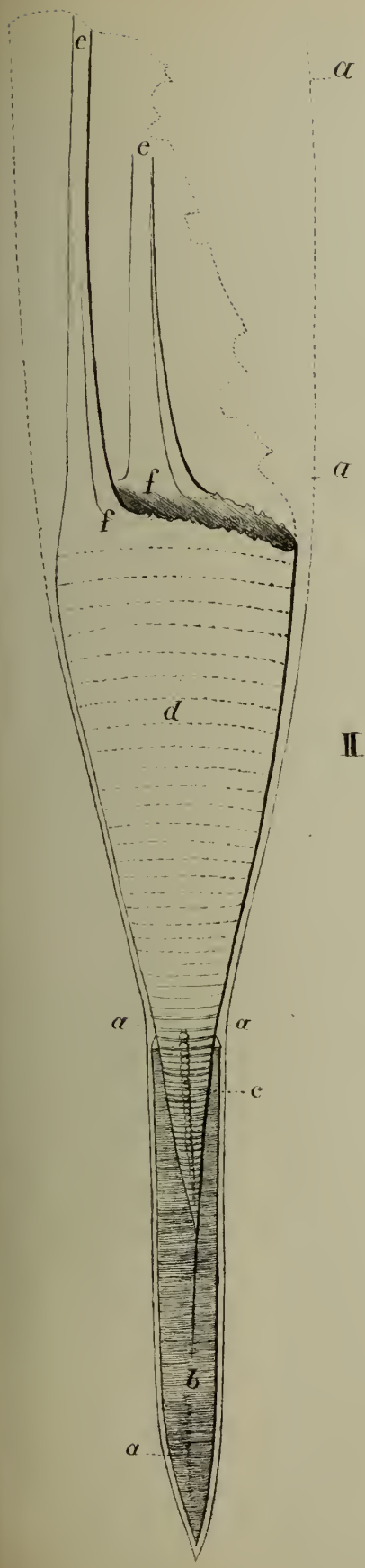

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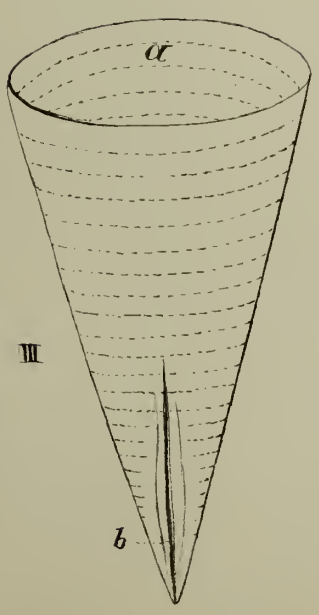

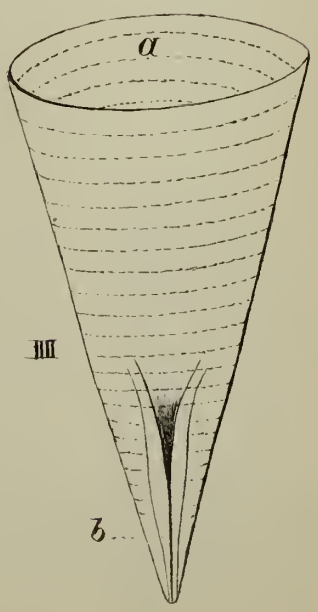

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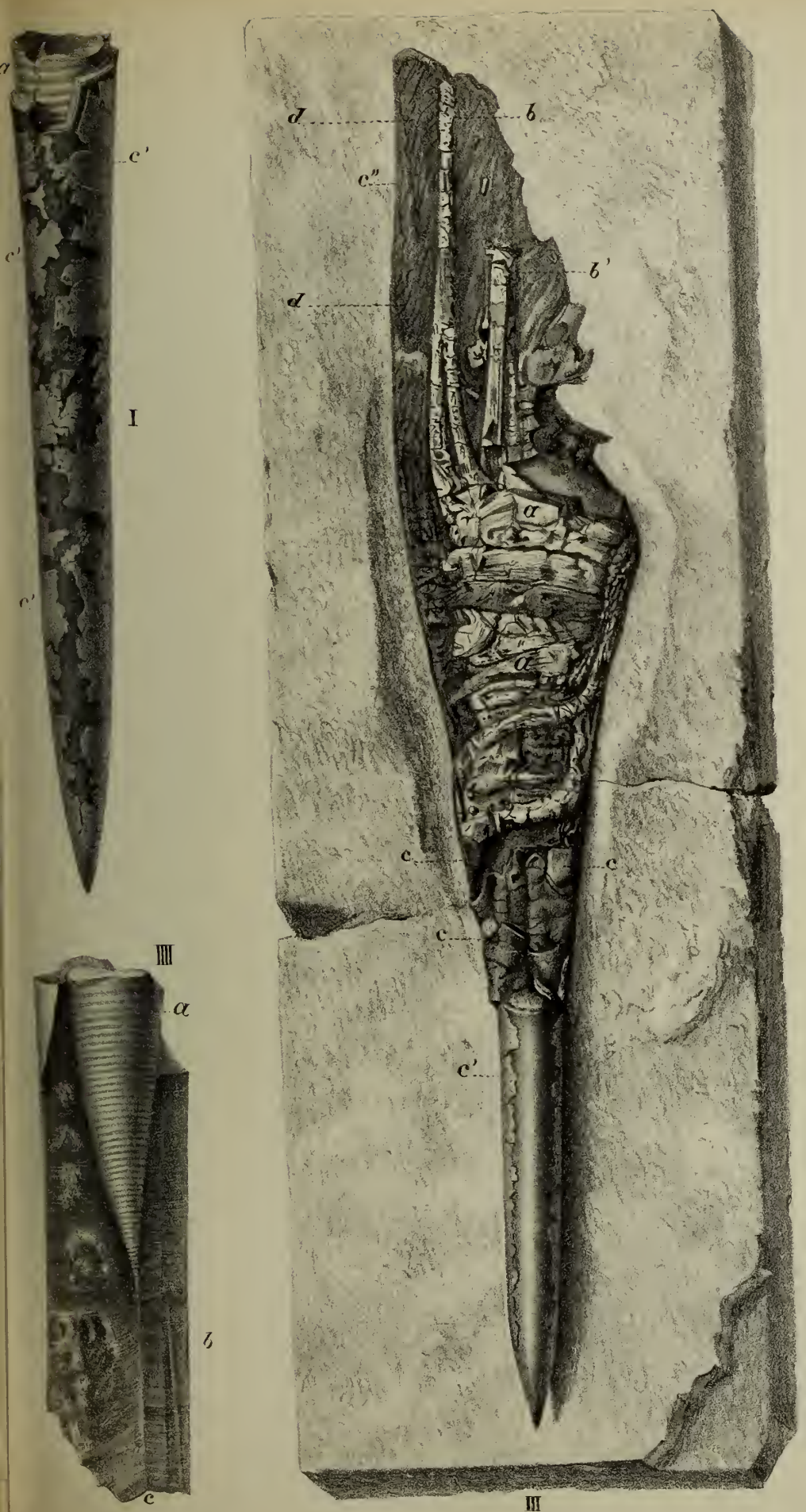

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